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Computer equipment in support of research in algorithmic methods in probability and operations research was acquired. That equipment serves the Laboratory for Algorithmic Research, Department of Systems and Industrial Engineering, University of Arizona.

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DR. JON A. SPOGREN	(202) 767-4940	AFOSR/NM

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FINAL REPORT ON DEVELOPMENT SUPPORTED BY

Grant Nr: AFOSR-89-0095

AT THE UNIVERSITY OF ARIZONA

The Laboratory for Algorithmic Research

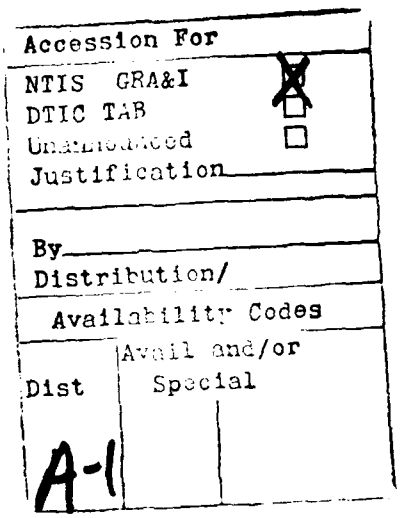
Submitted by:

Marcel F. NEUTS

Professor and Principal Investigator

Department of Systems and
Industrial Engineering
University of Arizona
Tucson Arizona 85721

(602) 621-4308



Title: Equipment in Support of Research on Algorithmic Probability

Period of Award: 12/01/88-11/30/89

Amount of Award: $101,892.-

Date submitted: February 28, 1990

1. GENERAL SUMMARY

This is a report describing the equipment purchased with the funds provided by Grant Nr: AFOSR-89-0095 and the significant role that equipment is playing in the establishment of and ongoing research in the Laboratory for Algorithmic Research in the Department of Systems and Industrial Engineering at the University of Arizona.

A comprehensive financial report has already been submitted by the Office of Sponsored Projects at the University.

2. THE LABORATORY FOR ALGORITHMIC RESEARCH

The Laboratory for Algorithmic Research in the Department of Systems and Industrial Engineering was established by Professors Marcel F. Neuts and Sidney Yakowitz in 1987. It provides a setting for faculty members and research students to share knowledge of algorithmic methodology and the use computer equipment in the study of problems of significance to engineering and operations research. During the three years of its existence, the Laboratory has had several highly productive research visitors and supports the thesis research of several doctoral students working with Neuts or Yakowitz. It provides an environment in which students can learn the intricacies of hands-on problem solving by computer, in association with faculty members and other persons with greater algorithmic experience.

Ongoing research in the Laboratory deals with procedures to approximate probability distributions by *phase type distributions*, (Dr. Mary A. Johnson, postdoctoral fellow), with queueing models motivated by applications in communications engineering (Professor Marcel F. Neuts and graduate assistants N. Surya and Dan Liu), with procedures to characterize the fluctuations in streams of packetized data (Professor Marcel F. Neuts and Ph. D. candidate Y. Chandramouli) and with methods for computer learning (Professor Sidney Yakowitz).

The Laboratory is open to all faculty members and graduate research assistants in the Department, who have need for the workstations which are now in place. Several graduate assistants working with other faculty members are now regularly making use of these facilities.

3. EQUIPMENT PURCHASED

At the time the Grant was received, the SIE department had just moved to the Engineering Building where it is now housed and where a large room was reserved for the Laboratory. That room had to be remodeled and prepared to house the library of books and software accumulated by Professor Yakowitz, as well as to provide the setting and the communication devices for a local area network based on the workstations to be purchased with the funds from the Grant.

After a careful review of our needs, we decided on an initial purchase of a SUN 3/60 and a SUN 386i workstation. These two units, the particulars of which are listed in the original Grant Proposal, were installed and became fully networked and operational in January 1989. In May 1989, a QMS-PS-810 laser printer was also acquired at very advantageous terms.

A sum of approximately $65,000 had been budgeted in the Grant for a more advanced workstation for which we had originally proposed the SUN 4/260, model 4/260C-P15. After review of the features of the SUN SPARC station 1, we decided to acquire two such workstations and we were able to do so at the extremely advantageous combined cost of $33,000. After some unavoidable delays in delivery and in the installation of additional networking equipment, all equipment became fully operational and networked in the Fall 1989.

The Laboratory now has fully adequate computer equipment for the foreseeable future. The funds provided by the Instrumentation Grant have been absolutely essential in bringing the Laboratory to its present state. Because of the advantageous terms at which we were able to purchase four, rather than three workstations, a residual sum of $30,971.19 was unspent and has been refunded by the University. The total cost of all computer equipment and peripheral items such as networking equipment acquired amounted to $70,920.81

The faculty members in charge of the Laboratory deeply appreciate the support provided by this Grant and we have strong hopes and confidence that the quality of the research supported by this equipment will fully justify the expenditure of public funds. While this is not the place to review the detailed research accomplishments, we have appended a list of recent technical reports and preprints written by persons associated with the Laboratory.

Laboratory for Algorithmic Research
Department of Systems and Industrial Engineering
University of Arizona
Tucson, Arizona 85721, U.S.A.

RECENT TECHNICAL REPORTS of the Laboratory

Colm Art O'Cinneide, *"Characterization of Phase-Type distributions"* Working Paper Nr. 88-018, November 1988. (forthcoming in Stochastic Models, Issue 6.1)

Marcel F. Neuts, *"Probabilistic modelling requires a certain imagination."* Working Paper Nr. 88-019, November 1988. Prepared for presentation at the Third International Conference on Teaching Statistics (ICOTS 3), August 19-24, 1990, Dunedin, New Zealand.

F. Thomas Bruss and L. C. G. Rogers, *"Embedding Optimal Selection Problems in a Poisson Process."* Working Paper Nr. 88-020, November 1988.

F. Thomas Bruss and Colm Art O'Cinneide *" On the maximum and its uniqueness for geometric random samples."* Working Paper Nr. 88-022, December 1988.

S. Sen and M. S. Dunatunga *"Successive piecewise linear approximations for separable nonlinear optimization."* Working Paper Nr. 88-023, December 1988.

Marcel F. Neuts, *"On Viterbi's formula for the mean delay in a queue of data packets."* Working Paper Nr. 89-001, January 1989. (forthcoming in Stochastic Models, Issue 6.1, preprint only available by e-mail)

Marcel F. Neuts, *"On the packet stream generated by a random flow of messages of random durations."* Working Paper Nr. 89-002, January 1989.

Marcel F. Neuts, *"Phase-type distributions: A bibliography."* Working Paper Nr. 89-005, February 1989.

Bernard F. Lamond, *"On the square wave spectrum of Markovian arrival processes."* Working Paper Nr. 89-009, March 1989.

Marcel F. Neuts and Charles E. M. Pearce, *"The superposition of independent discrete Markovian packet streams."* Working Paper Nr. 89-012, May 1989.

Marcel F. Neuts *"The joint distribution of arrivals and departures in quasi-birth-and-death processes."* Working Paper Nr. 89-017, June 1989. (forthcoming in the Proceedings of the Raleigh, North Carolina, Conference on Markov Chains.)

Bernard F. Lamond, *"An efficient basis update for asymptotic linear programming."* Working Paper Nr. 89-018, June 1989.

Bernard F. Lamond, *"Optimal Admission Policies for a Finite Queue with Bursty Arrivals."* Working Paper Nr. 89-024, October 1989.

Colm Art O'Cinneide, *"Phase-type distributions and invariant polytopes"* Working Paper Nr. 89-025, October 1989.

Higle, J. L. and Sen, S., *"On the convergence of algorithms with applications to stochastic and nondifferentiable optimization."* Working Paper Nr. 89-027, November 1989.

Higle, J. L. and Sen, S. *"Statistical verification of optimality conditions for stochastic programs with recourse"* Working Paper Nr. 89-028, November 1989.

Szidarovszky, F. and Koji Okuguchi, *"Dynamic oligopoly with complete information"*

Szidarovszky, F. *"On time dependent multistep dynamic processes with set-valued iteration functions."*

Szidarovszky, F. *"Global asymptotic stability of non-linear difference equations with non-differentiable functions."*

Szidarovszky, F. *"On the convergence of non-stationary algorithms modeled by point-to-set maps."*

Yakowitz, S. *"Some contributions to a frequency location method due to He and Kedem"*

Szidarovszky, F. and Koji Okuguchi, *"Dynamic oligopoly: Models with incomplete information"*

Johnson, M. A., and Taaffe, M. R., "An Investigation of Phase-Distribution Moment-Matching Algorithms for Use in Queueing Models" Working Paper No. 89-029, December 1989.

Bernard F. Lamond *"Approximate Spectral Analysis of Markovian Point Processes"* Working Paper No. 89-030, December 1989.

Yakowitz, S., T. Jayawardena, T. and Li, S. *"Theory for Automatic Learning under Markov-Dependent Noise, with Applications"* Working Paper No. 89-031, December 1989.